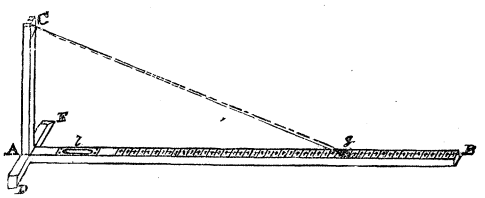
Under as recent a classification as that adopted by Lankester, in the new edition of the Encyclopaedia Britannica, this creature would form a new order, Amyaria, as opposed to the old Mono- and Dimy-aria. These orders being pretty generally given up, though not yet out of the text-books, it is probable that no others can yet be formulated. Whatever be its relations to the higher groups, a point to be determined by further study, there can be no doubt that the animal forms the type of a new family, Chlamydoconchae, and may take the name of Chlamydoconcha Orcutti. It is evident already, that the genus does nothing toward bridging the gap between the gastropods and pelecypods, but is simply a remarkably aberrant form of the latter group, and probably derived from some form with an external shell. It is able, according to Mr. Orcutt, by sphincter-like contractions of the mantle, to produce currents of water over the gills, which are probably finally ejected by the anal tube.

A paper on the subject, with figures, will be published shortly. WM. H. DALL.

Time without instruments.

Students usually feel little interest in the method of time in astronomy by 'a single altitude of the sun,' because they do not expect to own an instrument with which to measure the altitude. They can easily make the apparatus described below, by which, with careful handling, time may be found with a probable error of fifteen seconds.



Frame together the three pieces AB, AC, and DE, at right angles, — AB about sixty inches, AC eighteen inches and a half, and DE ten inches long, and each an inch and a quarter square. Cut a half-inch slit, one inch deep, in the end C, and in the direction AB. Fasten a piece of tin one inch square, with a hole an eighth of an inch in diameter, on the right-hand face of AC at C, with its hole opposite the centre of the slit. Set in a bubble at l by which to level AB. Let fall a perpendicular from the hole in the tin plate to AB; and at about twelve inches from the foot of that perpendicular commence the graduation on the centre line AB, dividing into inches and half-inches, and numbering 12, 13, etc., towards B. It will be well to paste a strip of drawing-paper on the face AB, on which to make the graduation.

Measure once for all the exact height in inches of the centre of the hole in the tin plate above the upper face of AB, which should be about eighteen inches, and multiply it by the decimal .9994358, which product designate by h. By using this for the height of AC, all altitudes will be corrected for mean refraction.

To use it, place in the sunlight, — best when the sun is not less than 16° nor more than 45° high, — with AB levelled by the bubble, estimating by eye when AC is perpendicular, so that the bright spot from the hole in the tin shall fall on the graduated centre line of AB. With watch in hand, read the hour, minute, and second when the centre of the elliptical bright spot is exactly on some dividing-line of the scale, and call the scale-reading r: then the sine of the sun's altitude $= \frac{h}{\sqrt{r^2 + h^2}} = \sin a$.

For the hour-angle $= P$, the most convenient formula is, — letting δ = sun's declination, and l = the latitude of the place, — $\cos P = \frac{\sin a - \sin \delta \sin l}{\cos \delta \cos l}$.

This formula, with the known latitude (say, 36° 12′ 45″), may be put in the form

$$\log \cos P = \log \{\sin a - [9.77143] \sin \delta\} + a.c. \log \cos \delta + 0.09322.$$

A nautical almanac is needed for declination and the equation of time, though tabulated mean values of these for every tenth day of the year will answer for the usual accuracy required in common local time.

The form of apparatus may be varied to suit the taste of the student, or he may use the tin disk with a plumb-line suspended from it, in connection with a straight-edge levelled by a carpenter's level, and these of any lengths he chooses.

Time by 'equal altitudes of the sun' may be found by the same device.

A. H. BUCHANAN.

Cumberland university, Lebanon, Tenn., July 4.

Rotation experiments on germinating plants.

The opposite growth of the root and stem of a germinating plantlet, under other influences than that of gravity, we have recently shown by the following experiments. A circular trough (seen in section, b b, fig. 1) some sixteen inches in diameter and three

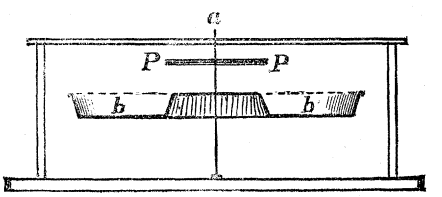


FIG. 1.

deep, rotates about the vertical axis a a. The trough, closely filled with earth, was planted with a quantity of well-soaked beans and seed-corn, and the whole covered with the fine gauze represented by the dotted lines. Forty-eight hours were allowed for the seeds to begin their growth, before the trough was started in rotation. By means of a Tuerk's motor, a uniform and continuous motion, at the rate of one hundred and eighty revolutions per minute, was then maintained for four days. At the end of this time the earth was carefully removed, and the positions of the young plants precisely noted. It was universally observed that the stems were accurately directed towards the axis, and the roots towards the circumference, of the trough. Figs. 2–6 represent several specimens. A B is the horizontal, A being towards axis, and B towards circumference; those of figs. 2, 5, and 6, were at a radius of six inches from axis; figs. 3 and 4 had radii of five and four inches. The curves at the points C, C, C, C, are quite significant, being the points to which the radicals had extended before